THE CHROMOSOMES OF A DISTINCTIVE PATAGONIAN ORTHOPTERAN INSECT, *CYLINDRORYCTES SPEGAZZINII* GIGLIO–TOS, 1914 (ORTHOPTERA – TRIDACTYLOIDEA – CYLINDRACHETIDAE).

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INTRODUCTION

Only seven species of Cylindrachetidae, one from New Guinea, five from Australia, and one from southern Argentina, have been described so far. For many years they were considered to be closely related to the mole crickets because of their body shape and the presence of a fossorial first pair of legs. In 1914 Giglio-Tos described*C. spegazzinii* and suggested that these strange insects are related to the embidiids rather than the mole crickets. Chopard (1918), however, found them related to the tridactylids. Crampton (1928), based on comparative corphology arguments, treated them again as gryllotalpids. It is Chopard's point of view which is the most widely accepted at present, and the cylindrachetids are now included with family rank within, the Tridactyoidea.

As far as the author knows, nothing up to date has been published on the cylindrachetid chromosomes. In the present paper, the chromosomes of *C. spegazzinii* are described and the cytological relationships with gryllotalpids and tridactylids discussed.

MATERIAL AND METHODS

A single male of *C. spegazzinii* collected in the locality of Bariloche, Neuquén Province, Rep. Argentina, at approx. 41° south latitude, on January 1973, was studied. The testes were fixed in ethyl alcohol-acetic acid (3:1) and stained with lacto-acetic orcein 2%.

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DESCRIPTION

The chromosome number of *C. spegazzinii* is 2n♂= 13 with a XO♂-XX♀ sex determining mechanism. The autosomes can be grouped into two pairs of large metacentric chromosomes and four pairs of medium size elements. Within the last group the longest pair is formed by acrocentric chromosomes while the remaining pairs are subacrocentric (fig. 2). Grouped in decreasing order of size, with the X chromosome at the end, the total length of the chromosomes given in arbitrary units, as well as the percentage of the shortest arm longitude over each total length are approximately as follows:

Chrom.	Long.	shortest arm. °/o
1	38	42
2	35	40
3	26	Very Small
4	23	17
5	20	10
6	15	13
X	43	28

During first prophase the second pair shows a heterochromatic segment at one of its ends (fig. 1, arrow). The X is submetacentric, the longest chromosome of the set and it appears completely heterochromatic during first prophase.

The, number of chiasmata was not measured but at first glance seems relatively high. The pairs four to six frequently show a chiasma in the small arm, as can be seen in the first metaphase of fig. 2.

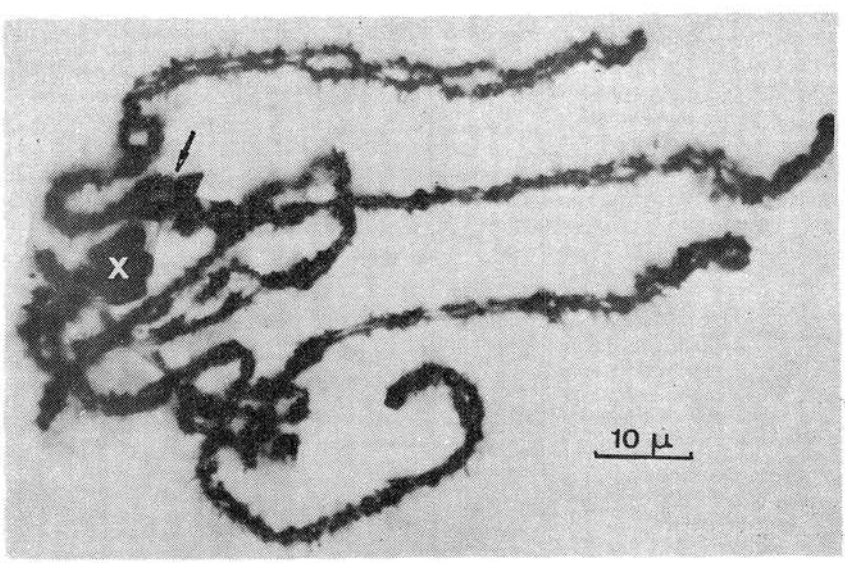

Fig. 1. *C. spegazzinii*. Very early diplotene.

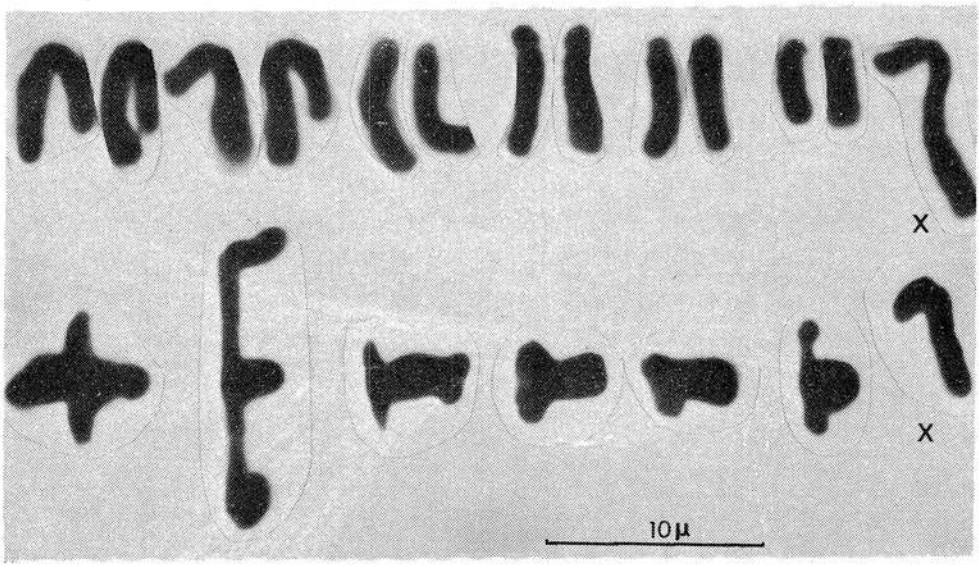

Fig. 2. *C. spegazzinii.* Above. Spermatogonial metaphase chromosomes in decreasing order of size with the X at the end. Below. First metaphase.

DISCUSSION

Cytological information on tridactylids is scanty. Ohmachi (1929) published on the chromosomes of *Tridactylus japonicus* which, according to that author, are 2n♂=13 with one pair of autosomes acrocentric while the remaining pairs are metacentric. The sex mechanism of this species is XO♂-XX♀. Powers (1942) mentioned the chromosome number of *T. sp.* and *Rhipipteryx sp.* as being 2n♂= 13 and 2n♂=15, respectively. Helwig (1958) added a drawing of a gonial metaphase of *R. sp.* Judging by his fig. 1, some of the autosomes seem to be metacentric. More recently, Gambardella (1976) published on the chromosomes of *R. notata* and showed a 2n♂= 15 with all the chromosomes either metacentric or submetacentric.

The information on mole cricket cytology is a little more extensive. The following species have a karyotype of 2n♂= 23: *Gryllotalpa africana* (Asana, Makino, and Niiyama (1940); Makino, Niiyama, and Asana (1940); Kushnir (1952); *G. himalayana* (Bhattacharjee and Manna (1967); *G. hexadactyla* (=*G. borealis)* (Payne 1912, 1916); White (1951); and *Scapteriscus tetradactylus* (Dreyfus 1942).

The species *G. gryllotalpa* has split into several cytological races which are apparently allopatric. However, from the taxonomic point of view, all of them seem to belong to a single species that extends over into Europe and the Mediterranean region. Their different karyotypes are as follows: 2n♂=12(XY) from France, Belgium, Germany, northern Spain, and northen Italy (Payne, 1916); de Winiwarter (1927, 1937); Ortiz (1951, 1958) 2n♂= 14 (XY) from Turkey and Rumania, (Steopoe, 1939); Kushnir (1952); 2n♂= 15 (XO) from southern Italy (Payne, 1916); de Winiwarter (1927, 1937); Barigozzi (1933); 2n♂=17 (XO) from southern Spain and probably central Italy (Ortiz 1951, 1958); Senna (1911); 2n♂=18 (XY) from northern Italy (Barigozzi 1942); Tosi (1959); 2n♂=19 (XO) fron Israel (a single locality) (Kushnir, 1948, 1952).

Two opposite interpretations have been advanced concerning chromosome evolution within the Gryllotalpidae. According de Winiwarter (1927, 1937), Barigozzi (1933), and Kushnir (1948, 1952), the lower chromosome number in mole crikets must be regarded as primitive. It is White's (1973) opinion, however, that 2n♂=23 has more chance of being the primitive number, and the changes in the chromosomal races of *G. gryllotalpa* must then have taken place by reduction through chromosomal fusion.

Judging, on the basic of the still fragmentary information on tridactylid chromosomes, the basic family karyotype seems to be 2n♂=13 or 15 with at least several pairs, including the X, metacentric or submetacentric.

If White's idea on mole cricket evolution is correct, the karyotype of *C. spegazzinii* with 2n ♂= 13 and two pairs of chromosomes plus the X submetacentric closely resembles the Tridactylidae rather than the Gryllotalpidae basic karyotype. Furthermore, this interpretation is in agreement with the taxonomist's modern point of view.

SUMMARY:

The karyotype of *C. spegazzinii* is 2n♂=13 with a X0♂-XX♀ sex mechanism. The autosomes comprise two pairs of large metacentric chromosomes and four pairs of medium size elements. Within the last group the longest pair is formed by acrocentric chromosomes while the remaining ones are subacrocentric.

The *C. spegazzinii* karyotype closely resembles that of the tridactilids.

REFERENCES

ANDER, K. 1934. Uber die gattung *Cylindracheta* und ihre systematische stellung (Orthoptera-Saltatoria). Ark. for Zool. 26 a (21): 1-16.

ASANA, J. J., S. MAKINO and H. NIIYAMA. 1940. A chromosomal survey of some Indian insects. III. Variations in the chromosome number of *Gryllotalpa africana* due to the inclusion of supernumerary chromosomes. J. Fac. Sci. Hokkaido Univ. Ser. VI 7: 59-72.

BARIGOZZI, C. 1933a. Die Chromosomen garnitur, der Maulwurfsgrille und ihre systematische bedeutung. Z. Zellforsch. 18: 626-641.

– 1933b. L'unicitá sella specie "Gryllotalpa gryllotalpa L." e il suo ciclo biológico. Boll. Lab. Zool. Portici. 27: 145-155.

BHATTACHARJEE, T. K. and C. K. MANNA. 1967. A cytological survey of Grylloidea. Proc. 54th Ind. Sci. Congr. 3: 420.

CARPENTIER, F. 1932. Sur quelques particularités du thorax et des pattes de *Cylindroryctes spegazzinii* Giglio-Tos. V^e^ Congres. Intern. Entom. 271-276.

CHOPARD, L. 1918. A propos des *Cylindracheta* genre de Gryllides endophyte. Bull. soc. entom. France, Paris 213-216.

CRAMPTON, G. C. 1928. Anatomical evidence that *Cylindracheta* is a Gryllotalpoid not an Embiid. Entom. Mitleil. Berlin-Dahlem 17: 252-257.

DREYFUS, A. 1942. Estudos sôbre cromosomas de Gryllotalpidae Brasileiros. I. Precessao, sincronismo e successao de cromosomas sexuais. Rev. Brasil. Biol. 2: 235-246.

GAMBARDELLA, L. A. de. 1976. Los cromosomas de *Rhipiptery notata* (Orthoptera: Caelifera: Tridactyloidea). Neotropica 22(67): 30-32.

GIGLIO–TOS, E. 1914. Sulle posizione sistematica del gen. *Cylindracheta* Kirby. Ann. Mus. Civ. Storia Nat. Geneva Ser. 3, 6: 81-21.

HELWIG, E. R. 1958. Cytology and Taxonomy. Bios 29 (2): 58-72.

KUSHNIR, T. 1952. Heterochromatic polysomy in *Gryllotalpa gryllotalpa* L. J. Genet, 50 (3): 361-383.

MAKINO, S., H. NIIYAMA and J. J. ASANA. 1938. On the supernumerary chromosomes in the mole cricket *Gryllotalpa africana* de Beauvois, from India. Jap. J. Genet. 14: 272-277.

OHMACHI, F. 1929. A short note on the chromosomes of *Tridactylus japonicus* de Haan and its taxonomical position. Proc. Imp. Acad. 5: 364-366.

ORTIZ, F. 1954. Los cariótipos de *Gryllotalpa gryllotalpa* (L.) de la península ibérica. Bol. Soc. Esp. Hist. Nat. 49: 153-158.

– 1958. El valor taxonómico de las llamadas razas cromosómicas de *Gryllotalpa gryllotalpa* (L.). Publ. Inst. Biol. Aglicades 27: 181-194.

PAYNE, F. 1912. The chromosomes of *Gryllotalpa borealis* Burm. Arch Zellforsch. 9: 141-148.
– 1916. A study of the germ ccells of *Gryllotalpa borealis* and *Gryllotalpa vulgaris*. J. Morph. 28: 287-327.
POWERS, P. B. A. 1942. Metrical studies on spermatogonial chromosomes of Acrididae (Orthoptera). J. Morph. 71 (3): 523-576
SENNA, A. 1911. La sper nat ›genesi di *Gryllotalpa vulgaris* Latr. Monit. Zool. Ital. 22: 65-77.
STEOPOE, I. 1939. Nouvelle recherches sur la spermatogenèse chez *Gryllotalpa vulgaris* de Roumanie. Arch. Zool. exp.-gèn. 80: 445-464.
TINDALE, N. B. 1928. Australasian molecrickets of the family Gryllotalpidae. Records S. Austr. Mus. Adelaide. 4 (1): 1-42.
TOSI, H. 1959. The chromosome sets of *Gryllotalpa* L. and their geographical distribution. Caryologia. 12: 189-198.
VOINOV, D. 1914. Recherches sur la spermatogenèse du *Gryllotalpa vulgaris* Latr. Arch. Zool. Exp. 54: 439-499.
– 1925. Los éléments sexuels de *Gryllotalpa vulgaris* Latr. Arch. Zool. Exp. et Général. 63: 437-523.
WHITE, M. J. D. 1951. Cytogenetics of orthopteroid insects. Adv. in Genet. 4: 267-330.
– 1973. Animal cytology and evolution. Cambridge Univ. Press. 961 p.p.
WINIWARTER, H. de 1927. Etude du cycle chromosomique chez diverses races de *Gryllotalpa gryllotalpa* L. Arch. Biol. Paris. 37: 515-572.
– 1937. Les chromosomes du genre *Gryllotalpa*. Cytologia. Fujii Jubilee Vol? : 987-994.